

Overview

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- The objective of the assessment was to assist the Owners to better understand the current status and potential challenges of the project and to help ensure the project is on the most cost efficient trajectory to completion.
- Based on our assessment, the current schedule is at risk. Significant issues include:
 - To-go scope quantities, installation rates, productivity, and staffing levels all point to completion later than current forecast.
 - While EPC plans and schedules are integrated; the plans and schedules are not reflective of actual project circumstances.
 - The Consortium lacks project management integration needed for EPC.
 - There is a lack of a shared vision, goals, and accountability between the Owners and the Consortium.
 - The WEC-CB&I relationship is extremely poor, caused to a large extent by commercial issues.
 - The Contract does not appear to be serving the Owners or the Consortium particularly well.
 - The issued design is often not constructible resulting in a significant number of changes.
- The oversight approach taken by the Owners does not allow for real-time, appropriate cost and schedule mitigation.

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Introduction

- The assessment was performed in accordance with an August 6, 2015 Professional Services Agreement between Bechtel Power Corporation and Smith, Currie & Hancock LLP (SCH) for the purpose of assisting SCH in giving legal advice.
- The objective of the assessment was to assist SCH and the Owners (South Carolina Electric & Gas Company and South Carolina Public Service Authority) to better understand the current status and potential challenges of the project in anticipation of litigation and also to help ensure the project is on the most cost efficient trajectory to completion.
- Bechtel's team evaluated the current status and forecasted completion plan through the design, supply chain, and construction aspects of the project.
 - Focus was on understanding the issues that have caused impacts to date, assessing the effectiveness of the mitigation plans put into place to address those issues, and reviewing the project management tools and work processes being employed to plan and execute the project, including change management, through completion and turnover of the units.
- Materials received, collected or prepared by Bechtel in connection with the assessment are the property of the Owners and shall be treated as confidential.

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Assessment Timeline

- **Schedule:**
 - Issue draft report 7 weeks following site mobilization for Owners' review.
- **The assessment included:**
 - Data validation
 - Site walkdowns
 - Leadership team interviews
 - Functional breakout sessions
 - Preparation of report
- **Key dates:**
 - August 14: Initial documents received from Consortium
 - August 19: Portions of Integrated Project Schedule received
 - September 8: Bechtel Team mobilized to site
 - September 9: Consortium presentation to Bechtel Team
 - October 22: Bechtel presentation to SCE&G and Santee Cooper

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Assessment Scope

- During the assessment period, the Bechtel team:
 - Reviewed 353 Consortium and Owner documents.
 - Attended 70 meetings with Consortium and Owner personnel.
 - Conducted 35 interviews of Consortium and Owner personnel.
 - Completed 24 site walkdowns/real-time observations.
 - Attended 7 subject-specific presentations.
- Bechtel's assessment is based on the data, schedule, and other information obtained from the Consortium and the Owners:
 - Construction bulk quantities were obtained from the Consortium (various questions on these quantities were identified).
 - Some data and information was provided electronically by the Owners and the Consortium. For the majority of data and information, a single hard copy was placed in a Reading Room at the site and no additional copies could be made. This limited our ability to fully assess the information [e.g., engineering schedules, ROYG (red-orange-yellow-green) report, etc.]
 - Many documents were redacted.
- Only key observations are identified in this presentation. Additional observations will be included in the final report.

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- 14 senior managers supported by Bechtel functional departments
- Over 500 years of total experience
- Over 300 years of EPC nuclear experience
- Experience on over 85 EPC projects

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Project Management

Key Observations and Recommendations

- The Consortium's project management approach does not provide appropriate visibility and accuracy to the Owners on project progress and performance.
- There is a lack of accountability in various Owner and Consortium departments.
- The Consortium's lack of project management integration (e.g., resolution of EPC issues) is a significant reason for the current construction installation issues and project schedule delays.
- The approach taken by the Owners does not allow for real-time, appropriate cost and schedule mitigation.

Recommendation:

- » Owner: Develop an Owners' Project Management Organization and staff it with EPC-experienced personnel who are empowered with the roles, responsibilities, and accountabilities for making the needed project-related decisions to keep the project on track.
- » Consortium: Assign recognized high-performing personnel to the current Consortium management personnel (i.e., shadow positions) as part of a major improvement plan.

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Project Management

Key Observations and Recommendations (cont'd)

- The WEC-CB&I relationship is extremely poor, caused to a large extent by commercial issues.

Recommendation: The Owners should take an active role in determining the reason(s) for the relationship and develop an action plan, including possible new contract terms, to fix the relationship.

- The overall morale on the project is low.

Recommendation:

- » The Project needs to experience some successes, no matter how small. Publish and post scheduled activities for the coming months around the job site. Post activities that have a high likelihood of being completed within schedule. Reward those responsible for achieving success (i.e., make success contagious).
- » Recognize individuals for their contributions to the project. For example, have an employee of the month from the various functions/various craft trades and publicly reward them. Rewards could include preferred parking for a month, gift certificates, etc.

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Project Management

Key Observations and Recommendations (cont'd)

- It appears that the Contract has created an imbalance between the Owners and the Consortium. The Consortium does not appear to be commercially motivated to meet Owner goals.
- WEC Engineering has not been completely responsive to Procurement and Construction requests for clarification and changes (e.g., timeliness, constructible designs); this is believed to be caused mostly by the commercial situation (i.e., WEC fixed price engineering).
- The Consortium's commercial structure, while not shared, is outwardly affecting the day-to-day working relationships between the Consortium partners and is creating performance issues, including significant non-manual turnover.

Recommendation:

- » Align commercial conditions with the project goals.
- » Facilitate Owner and Consortium teambuilding. If necessary, replace personnel with others that share the goals developed by the project.
- » Determine the realistic to-go forecast costs for the project.

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Engineering & Licensing

Key Observations and Recommendations

- Based on the team's observation of current civil work, the issued design is often not constructible (currently averaging over 600 changes per month). The complexity of the engineering design has resulted in a significant number of changes to make the design constructible.

Recommendation:

- » Locate dedicated WEC engineering response teams to the site with design authority to resolve current Engineering & Design Coordination Reports (E&DCR) problems.
 - » Establish a WEC/CB&I "Light Structures" design organization at the site to work with construction to redesign and reissue piping, HVAC, conduit, and tray supports.
- The construction planning and constructability review efforts are not far enough out in front of the construction effort to minimize impacts.

Recommendation: Intensify efforts of Strategic Planning Group, work package planning, constructability reviews, etc. to early identify design changes needed.

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Engineering & Licensing

Key Observations and Recommendations (*cont'd*)

- Resolution of many E&DCRs is behind schedule. The E&DCR backlog is not decreasing.

Recommendation: Provide additional staffing to address emergent E&DCRs and work off current backlog. Locate more appropriate resources to the site to address early any emergent E&DCRs.

- Engineering staffing remains extremely high (around 800 total engineers for WEC and CB&I) for the reported percent complete of the design; however, it appears that the staffing is needed to complete the design and provide support to construction.

Recommendation:

- » Allocate dedicated resources to complete and issue the remaining design on or ahead of current schedule which is ~~at~~ the end of 2016.
- » Plan to reduce engineering headcount and aggressively monitor.

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Engineering & Licensing

Key Observations and Recommendations (*cont'd*)

- There is significant engineering and licensing workload remaining for electrical design, I&C, Post-Design Engineering Closure Plan, ITAAC closure, etc. Much of this remaining engineering will potentially impact construction.

Recommendation:

- » Allocate dedicated resources to complete and issue the remaining design on or ahead of the current schedule which is approximately the end of 2016.
 - » Convene a group of SMEs and commit to completing the scoping, resource loading, and scheduling of Post-Design Engineering Closure Plan work by no later than 1Q2016.
- 119** license amendment requests (LARs) and 657 departures have been identified to date. This is a significant project workload that appears to be well planned and scheduled. Interactions with the NRC are good with a focus on meeting construction need dates (CNDs). Emergent issues potentially requiring NRC approval of LARs remain a significant project concern.

Recommendation: Continue planning and scheduling efforts for LARs and departures and active interactions with NRC to meet CNDs. Intensify efforts of Strategic Planning Group, work package planning, constructability reviews, etc. to emphasize early identification of potential departures.

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Procurement

Key Observations and Recommendations

- There is a significant disconnect between construction need dates and procurement delivery dates. There are:
 - 457 open WEC and 2,907 open CB&I equipment deliveries.
 - 31 WEC and 28 CB&I Standard Plant POs to be placed.
- The ROYG (red-orange-yellow-green) report is described as inaccurate.

Recommendation:

- » The Consortium should complete their schedule adherence effort by 10/31/15 so that mitigation plans can be implemented, resulting in the ROYG report properly addressing CNDs, PO awards, and supplier deliveries.
- » Assess resource needs to properly manage this activity.
- The amount of stored material onsite is significant, creating the need for an extended storage and maintenance program. Inventory validation in the yard is reported to be only at 48% accuracy.

Recommendation: Investigate and determine if component and material deliveries can be delayed for shipment (i.e., delay fabrication and delivery to minimize onsite storage durations) in order to minimize the need to perform extended period PM and storage actions on site. Implement every opportunity to minimize onsite storage duration after initial delivery.

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Procurement

Key Observations and Recommendations (cont'd)

- The current Min/Max warehousing program is insufficient for the scale of the construction effort, which is impacting productivity.

Recommendation:

- » Expedite the finalization of the Min/Max strategy and implementation of the identified Blanket Purchase Orders (BPOs) so that construction can use them, versus writing individual material requisitions.
- » In reviewing the report of BPOs in place that would support a Min/Max system, there must be further discussion with construction and field engineering as to what products should be maintained within the Min/Max system.
- » Educate site personnel on the use and process of the BPOs and the Min/Max system. It was evident that material was ordered versus use of Min/Max – BPOs.

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Construction

Key Observations and Recommendations

- Construction productivity is poor: Unit 2 is 2.3, Unit 3 is 1.6.

Recommendation:

- » Achieve more timely resolution of engineering issues.
 - » Assemble a team of subject matter experts to review proposed resolutions.
 - » Re-assess tolerances and repair procedures to give construction more latitude in resolving issues.
 - » Simplify the work packaging process (see next slide).
 - » Efforts need to be made to keep the craft at the workface (have coffee breaks and lunch at their place of work).
- Manual and non-manual sustained overtime is negatively affecting productivity.
- ### Recommendation:
- » The work week should be reduced to no more than 48 hours (four 10 hour days, one 8 hour day). Spot overtime beyond 48 hours should be kept to a minimum.
 - » Consider craft incentive plan.

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Construction

Key Observations and Recommendations (*cont'd*)

- CB&I's work packaging procedures are overly complex and inefficient, directly affecting craft productivity.

Recommendation:

- » Simplify the process.
- » Reduce the scope of the package.
- » Limit the foreman's package to only the information needed.
- » Incorporate changes into the design drawings before work begins.

- Aging of the construction workforce is impacting productivity.

Recommendation:

- » Develop mentoring and training plan to promote junior craft and field engineering personnel with periodic evaluations and feedback sessions.
- » Create and staff shadow positions for senior level positions within the Consortium intent on developing new talent that is focused on project completion.

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Construction

Key Observations and Recommendations (*cont'd*)

- The indirect to direct craft ratio (1,100 persons to 800 persons) is very high at 130% (typical mega-project is 35 to 40%).

Recommendation: Develop a plan to identify targeted reductions to reduce the indirect ratio to a reasonable level and monitor it weekly.

- Field non-manual turnover is high at 17.4% per annum.

Recommendation: Perform evaluation of high turnover rate to correct the problem.

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Construction

Key Observations and Recommendations (*cont'd*)

- The workable backlog can support significantly more than the current craft workforce. The current construction percent complete per month is only 0.5%.

Recommendation:

- » Staff up to work available areas.
 - » Increase the amount of time the craft are at the workface. Perform time and motion study.
 - » Consider combining the Unit 2 and 3 Nuclear Island teams to reduce non-manual staffing and allow flexibility when issues are encountered.
 - » Use the onsite training facility and local vocational schools to train more crafts that can't be recruited (rebar ironworkers now; pipefitters and electricians in the future).
- The project safety, housekeeping, and quality records are very good.
- Recommendation:** Keep up the good work! Consider simplifying the tailgate write-up so it can be more easily understood and retained. Reconsider need for each craftsman to sign the morning bulletin.

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Start-Up

Key Observations and Recommendations

- The startup test program schedule is in the early stages of development.

Recommendation: Expedite the effort to reconcile the Component Test and Pre-Operational Test system templates currently loaded in the project schedule to the actual systems' scope and estimated unit rates. Completing this activity is critical to having a reasonable understanding of the overall project completion schedule.

- The current boundary identification package (BIP) turnover rate appears to be overly aggressive and not consistent with the current construction completion schedule.

Recommendation: Reconcile the timing of BIP turnovers to the planned construction percent complete dates. This will impact when Component Testing and Pre-Operational testing activities will occur, thus driving the project completion schedule.

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Project Controls

Key Observations and Recommendations

- The Consortium's forecasts for schedule durations, productivity, forecasted manpower peaks, and percent complete do not have a firm basis.

Recommendation: See Schedule Assessment (starts on next slide).

- The Owners do not have an appropriate project controls team to **assess/validate** Consortium reported progress and performance.

Recommendation: Form Owners' Project Controls team (Project Controls Manager, Lead Planner, Lead Cost). Establish tracking tools separate from the Consortium for verification of project progress and performance. Require the appropriate level of detailed information from the Consortium.

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Schedule Assessment

Key Bases

- Data from 21 completed nuclear units and 4 units in the planning phase was used.
- Civil/steel activities:
 - Walked down and assessed based on current progress and performance.
- Bulk commodities and major equipment:
 - Logic and installations derived from Bechtel historical data.
 - Median sustained rates from Bechtel historical data used for creation of installation durations.
- Craft:
 - Peak craft limited by building saturation levels.
 - All activities worked on a 48 hour week; second shift at 200%.
 - Indirect to direct craft ratio is 35% (currently 130%).
- Stagger between Unit 2 and Unit 3 commercial operation dates:
 - Based on critical craft peaks (pipefitters including welders & electricians).

Schedule Assessment

Key Assumptions

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- Current civil progress and performance will remain unchanged.
- Piping and electrical progress and performance is based on similar Bechtel experience.
- Sufficient quality craft is available up to 3,700 peak.
- All modules and material will be available to support the assessed construction dates.
- Preventive maintenance keeps all equipment operationally ready.
- Quantities provided by the Consortium were used and are accurate:
 - Exception: The annex building quantities are considered unreliable, hence schedule extension due to higher than expected quantities in this area not included.
- No construction equipment limitations.
- Design and work packages are available to support construction need dates.
- The following items do not enter the critical path:
 - NRC approval of license amendment requests
 - ITAAC closures
 - Cyber security
 - Simulator construction and operator qualifications

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Schedule Assessment

Preliminary Results

- Preliminary assessment of the Unit 2 and 3 Commercial Operation Dates based on the Key Bases and Assumptions stated above:

	Unit 2	Unit 3
Current COD	June 2019	June 2020
Adjustment	18 to 26 months	24 to 36 months
New COD	Dec 2020 to Aug 2021	June 2022 to June 2023

- The critical path will change from the shield wall to more typical bulk installations through overall project checkout and testing/start-up.
- Increasing schedule confidence to 75% increases the schedule duration by 8 months (included in the 26 months for Unit 2 and the 36 months for Unit 3).
- The stagger between the Unit 2 and 3 CODs extends by 6 months to 18 months.
- The peak monthly construction percent complete is reduced from 3.1% to 2.3%.
- Primary checkout window adjusts by 6 months to 18 months per unit.
- Total craft population increases by 25% to ~3,700.
 - At peak, 850 pipefitters and 730 electricians are required.
- Bulk installation durations increased by a minimum of 30%.

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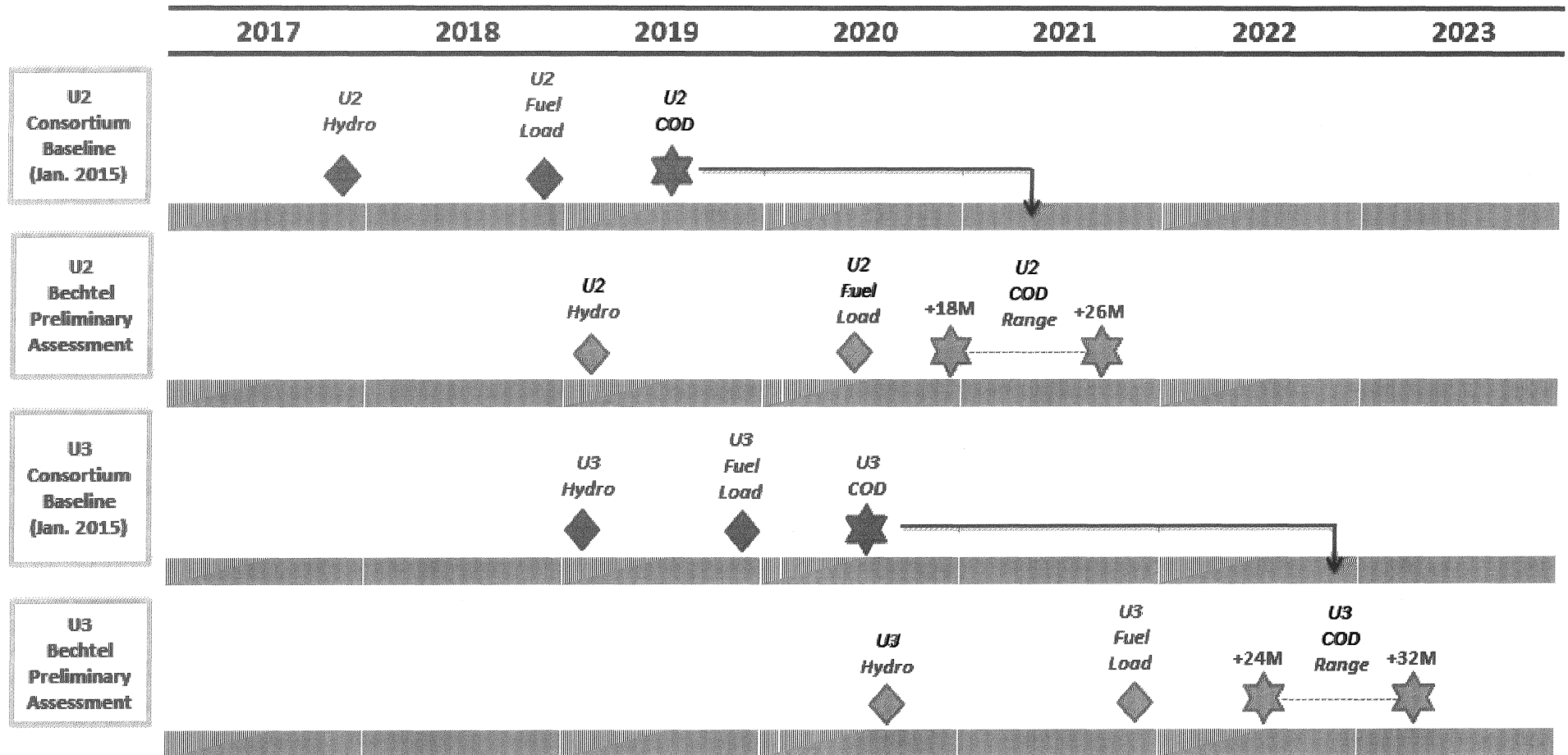
Schedule Assessment

Preliminary Results *(cont'd)*

- **Schedule Probability Assessment:**
 - Only performed on critical path and top 4 near critical paths because of time limitations.
 - Typical 11,000 iteration Monte Carlo approach.
 - Minimum/maximum windows provided by senior construction personnel on assessment team.
 - Minimum/maximum historical bulk installation rates used as secondary verification method.
 - Only preferential logic considered.
 - Identification of required contingency for assessment purposes only.
 - A more robust approach is needed prior to finalization of any changes to the baseline target schedule.

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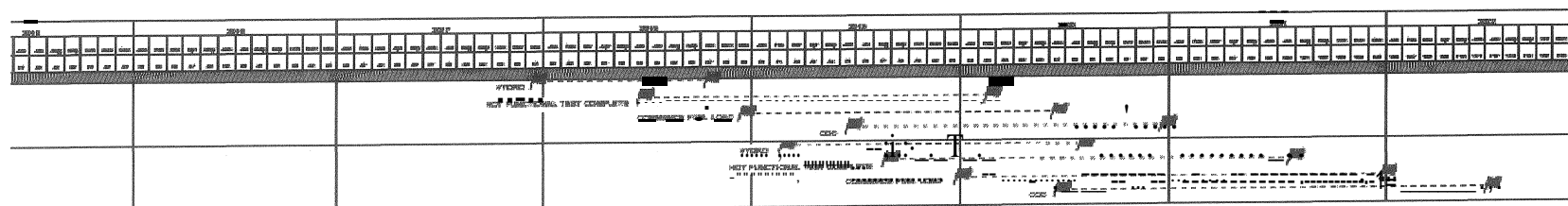
Schedule Assessment Milestone Comparison



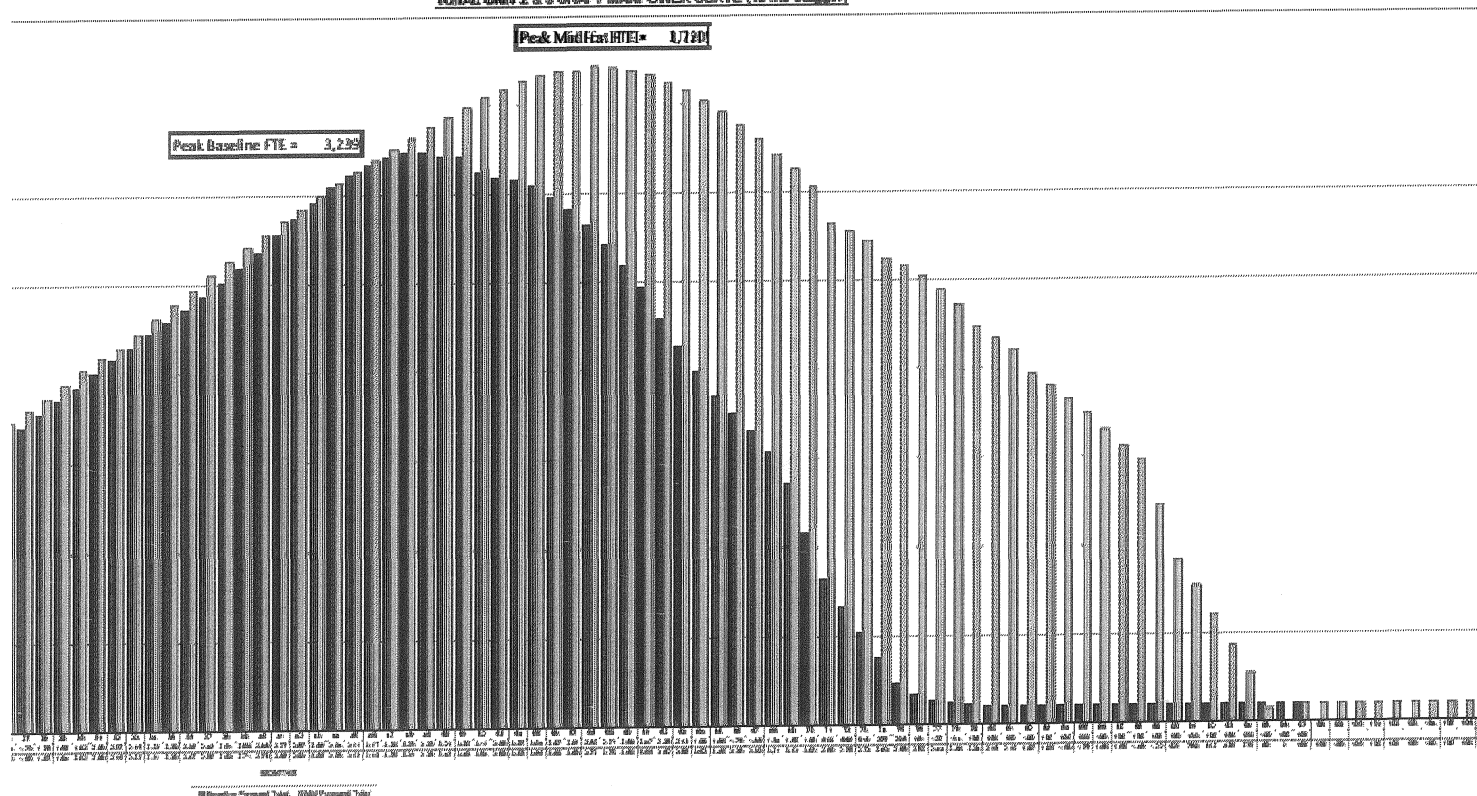
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Schedule Assessment

Total Craft Manpower Comparison



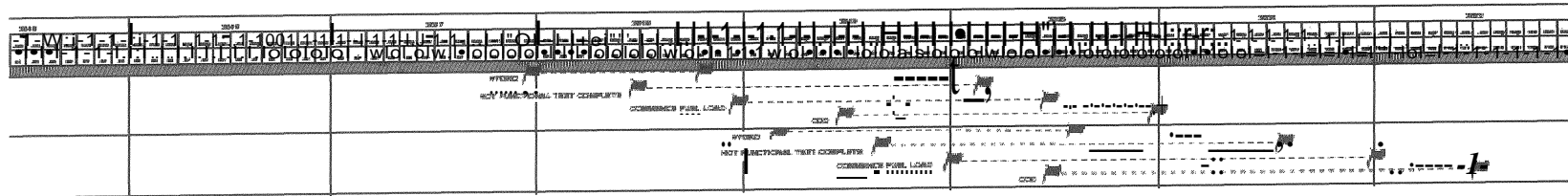
WG SUMMER
TOTAL UNIT 2 & 3 CRAFT MANPOWER CURVE (18 mo stagger)



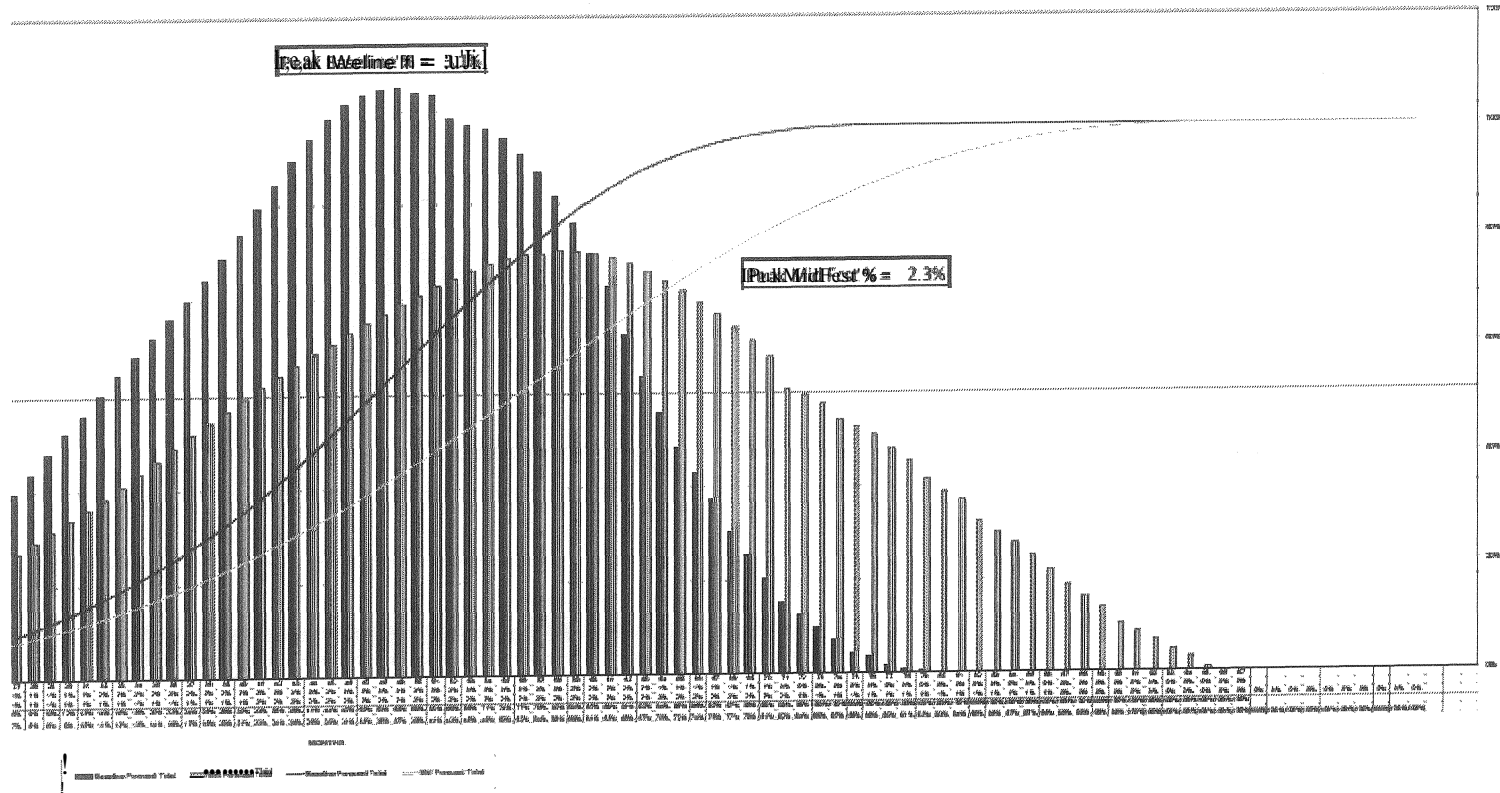
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Schedule Assessment

Construction Percent Complete Comparison



V.C. SUMMER
TOTAL UNIT 2 & 3 PERCENT COMPLETE CURVE



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Preliminary Conclusions

- The AP1000 is a first-of-a-kind technology, 10 CFR 52 is a new licensing process, and these are the first new nuclear plants being constructed in the U.S. in decades. Challenges would be expected.
- However, the V.C. Summer Units 2 and 3 project suffers from various fundamental EPC and major project management issues that must be resolved for project success:
 - The Consortium's project management approach does not provide appropriate visibility and accuracy to the Owners on project progress and performance.
 - The Consortium's forecasts for schedule durations, productivity, forecasted manpower peaks, and percent complete do not have a firm basis. Bechtel's preliminary assessment of the Unit 2 and 3 Commercial Operation Dates indicates:

	Unit 2	Unit 3
Current COD	June 2019	June 2020
Adjustment	18 to 26 months	24 to 36 months
New COD	Dec 2020 to Aug 2021	June 2022 to June 2023